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Vessel Response to Drug-Eluting Stents in Patients With vs. Without Diabetes Mellitus: Pooled Volumetric Intravascular Ultrasound Analysis

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Background: Diabetes mellitus (DM) is an independent predictor of in-stent restenosis after bare-metal stent implantation because of exaggerated neointimal hyperplasia. However, the vessel response in patients with and without DM who are treated with the currently approved drug-eluting stents (DES) has not been well documented with detailed 3D IVUS analysis.
Methods: From the Core Laboratory database, 971 patients (267 with DM and 704 without DM) treated with sirolimus- (n=104), paclitaxel- (n=303), zotarolimus- (n=391), or everolimus- (n=173) eluting stents were enrolled. In addition to standard 3D IVUS parameters, cross-sectional and longitudinal severities of lumen encroachment by neointima were assessed at prospectively scheduled follow-up (6-9 months) regardless of symptom as a part of clinical research protocols.
Results: At post-procedure, lumen volume index (VI) was significantly smaller in DM than in non-DM, whereas vessel VI was similar between the two groups. At follow-up, % neointimal obstruction, maximum %cross-sectional narrowing (%CSN: neointimal area / stent area), and IH50 (% stent length with CSN >50%) were not significantly different between the two groups with no interaction for the DES type. Consequently, lumen VI was smaller in DM than in non-DM at follow-up.

	DM (N=267)	Non-DM (N=704)	Adjusted p	p for interaction
Vessel VI at post-procedure	13.4±4.2	13.9±4.2	0.09	0.91
Vessel VI at follow-up	13.7±4.2*	14.4±4.4*	0.0457	0.94
Lumen VI at post-procedure	6.6±1.9	7.3±2.1	<0.0001	0.85
Lumen VI at follow-up	6.0±1.9*	6.5±2.1*	0.0037	0.66
% change in vessel VI	2.8±9.8	3.5±8.1	0.22	0.97
% change in lumen VI	-8.7±13.3	-10.6±13.1	0.14	0.58
% neointimal obstruction	11.1±10.6	11.9±10.5	0.22	0.78
Max %CSN	26.9±17.2	27.0±16.3	0.75	0.84
IH 50	1.8±7.1	1.6±7.8	0.59	0.99
*p<0.05 vs. valuable at post-procedure, VI: Volume index (mm^3/mm)				

Conclusions: DES attenuated excess risk of exaggerated and heterogeneous pattern of neointimal hyperplasia in DM regardless of the DES type, demonstrating similar vessel responses in the DM and non-DM patients. In the DES era, follow-up lumen in DM patients appears to be determined primarily from the degree of stent expansion at post-procedure rather than neointimal proliferation.

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Impact of Lumen Narrowing Within Drug-Eluting Stents and Bare-Metal Stents on Downstream Vessel Segments

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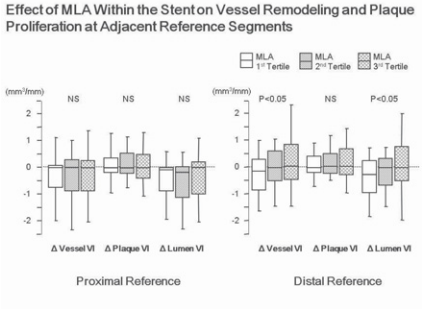
Background: Flow dynamics and shear stress within stents may influence downstream vessel segments. The aim of this study was to investigate the potential impact of lumen narrowing within bare-metal stents (BMS) and various drug-eluting stents on vessel response at adjacent reference segments.
Methods: Serial (baseline and 8-9 months) volumetric IVUS was performed in 557 lesions treated with BMS (n=48), sirolimus- (n=123), zotarolimus- (n=208), paclitaxel- (n=56), or everolimus- (n=122) eluting stents. For the entire stent and adjacent reference segments (up to 5 mm), volume index (VI: volume/length) was obtained for vessel, plaque, and lumen (VVI, PVI, and LVI).
Results: There was no relationship between in-stent MLA at follow up and the serial changes at the proximal reference. In contrast, in-stent MLA at follow up was positively related to ΔLVI and ΔVVI (follow up - baseline) at distal reference. In a multiple linear regression analysis with adjustment for clinical characteristics, procedure, and angiographic variables, in-stent MLA at follow up was independently associated with ΔLVI at the distal reference (β=0.34, p<0.05). At the distal reference segment, ΔLVI correlated strongly with ΔVVI (r=0.75, p<0.0001), but only weakly with ΔPVI (r=0.38, p<0.0001).



Conclusion: Regardless of the types of pharmacologic agents and delivery systems, in-stent lumen patency, or maintaining proximal laminar flow, may consistently play a role in the distal reference vessel response.

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Intravascular Ultrasound Data Analysis in Patients Undergoing Drug Eluting Stent Implantation for Unprotected Left Main Bifurcation Disease

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Background: Using intravascular ultrasound (IVUS), we assessed the plaque distribution at the left main coronary artery (LM) and the impact of the pre-procedural lesion characteristics on stent expansion in patients undergoing DES implantation for unprotected LM disease.
Methods: Four segments of LM bifurcation were defined by IVUS images. Using left anterior descending artery (LAD) pullback, we evaluated ostial LAD (3mm distal to the carina), polygon of confluence (POC, a confluence zone of LAD and left circumflex artery [LCX] on longitudinal image) and DLM (distal LM 3mm just proximal to the POC) before and after stenting. Separately, ostial LCX (3mm distal to the carina) was assessed by LCX-pullback. IVUS measurement was performed at the minimal lumen area (MLA) site of each segment.
Results: Total 82 LM bifurcations with pre-procedural both pullback IVUS were evaluated. Pre-procedural MLA and post-stenting MSA of LM were mainly located in POC (51% and 71%). On ROC curve analysis, the cut-off value of the MLA within the POC was 6.1 mm^2 to predict significant stenosis of LCX carina with 83% of sensitivity and 52% of specificity (AUC=0.7, 95% CI=0.57-0.78, p<0.001). The positive and negative predictive values were 55% and 81%, respectively. The MLA of DLM (β=0.601, 95% CI=0.43-0.75, p<0.001), the lumen area of LAD carina (β=0.176, 95% CI=0.02-0.4, p=0.035)and the lumen area of LCX carina (β=0.171, 95% CI=0.01-0.3, p=0.045) independently affected the MLA of POC. Multivariate analysis identified the lumen area of LCX carina (β=0.343, 95% CI=0.15-0.43, p=0.003) and the MLA of DLM (β=0.236, 95% CI=0.01-0.33, p=0.037) as the independent predictors for the post-stenting MSA within the distal portion of LM above the carina.
Conclusion: The MLA within the POC obtained by simple LAD pullback was a good surrogate reflecting the overall severity of LM bifurcation disease. The smaller pre-procedural lumen area of LCX carina and the MLA within the DLM mainly affecting the smaller MLA within the POC were the independent predictors for the stent underexpansion within the distal segment of LM bifurcation.

TCT-63

Coronary Computer Tomography Angiography Quantitative Lesion Assessment Compared with Intravascular Ultrasound in Patients With Coronary Artery Disease

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Background: Coronary Computer Tomography angiography (CCTA) could provide valuable information to guide percutaneous coronary interventions if coronary lesions can be accurately evaluated with this non-invasive technology. Thus, the purpose of this study is to compare different pre-operative CCTA quantitative measurements with intra-vascular ultrasound measurements obtained during invasive coronary angiography.
Methods: Forty five patients with coronary lesions documented using a Phillips Brilliance 64-multislice CCTA scanner that underwent coronary angiography where enrolled in the study. All patients underwent quantitative CCTA using maximum intensity projections with multi-planar reconstruction and curve planar reformatted CTA with a TeraRecon Aquarius workstation. Same coronary lesions where examined with IVUS using a motorized pullback. Lesion length, proximal and distal reference vessel dimensions, minimal luminal dimension (MLD), minimal luminal area (MLA) and minimum-percentage-area stenosis where compared with both techniques using a Peasons correlation coefficient.
Results: 25 (55%) where males, with an average age of 62 ± 15 Years. 12 lesions were located in the RCA, 10 in the LCX and the rest in the LAD. Results are depicted in the table.

Parameter	CCTA Average± (SD)	IVUS Average± (SD	Correlation	p
Lesion Length (mm)	17±8	16±7	0.856	<0.001
Prox. Reference (mm)	2.8±0.4	3.0±0.6	0.840	<0.001
Distal Reference (mm)	2.6±0.8	2.7±0.5	0.957	<0.001
MLA (mm2)	2.56±0.65	2.85±0.9	0.811	<0.05
MLD (mm)	2.01±0.25	2.8±0.50	0.533	0.010
% Area Stenosis	82±16	68±11	0.236	0.182

Conclusions: IVUS and CCTA have and excellent correlation measuring lesion length, and proximal and distal vessel reference dimensions. A more modest correlation was found in the evaluation of MLA, and a poor correlation was observed regarding MLD and minimum-percentage-area stenosis.

TCT-64

The Prevalence of Luminal Stress Interface Mismatch Points On Virtual Histology Analysis is an Accurate Indicator Of Plaque Vulnerability: Insights From the V-HEART Study

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Background: As the majority of acute coronary events are triggered by plaque rupture, defining the structural features of ruptured plaques should be of high importance. Biomechanics suggests that the interface of dense calcium (DC) deposits within a confluent necrotic core (NC) may be a determinant of thin cap fibroatheroma (TCFA) stability. We studied this relationship *in-vivo* with intravascular ultrasound derived virtual histology (IVUS-VH). We observed the prevalence of these luminal stress interface mismatch points between NC and DC (SIMPs) in different plaque types. Our hypothesis was that SIMPs will be more prevalent in high risk plaques.
Methods: This was a single centre, prospective, observational study with ethical approval. We completed IVUS-VH imaging in the culprit lesion (CL), adjacent non-culprit disease (NCD) in the ACS patient, and a control group with stable angina (SA). Within the group of CLs, a subgroup of ruptured plaques were assessed by excluding mobile thrombus from the VH analysis, to focus on the features of rupture associated plaque (RAP). Each other plaque type was analysed for luminal SIMPs at the minimum lumen area (MLA) and the point of maximum NC (MAX NC).

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